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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/921,150	08/02/2001	Jin Chuan Bai	MM4460	7226

7590 11/07/2002  
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NEW YORK, NY 10020-1182

EXAMINER

ZARNEKE, DAVID A

ART UNIT	PAPER NUMBER
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2827

DATE MAILED: 11/07/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/921,150

Applicant(s)

BAI, JIN CHUAN

Examiner

David A. Zarneke

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_ 6) ☐ Other: \_\_\_\_.

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's arguments filed 10/8/02 have been fully considered but they are not persuasive. Applicant argues that Ito uses spherical bumps that, when the chip is attached, protrude from the surface of the encapsulant as shown in Figure 7. This teaches away from the present claims in that the present claims call for a coplanar surface between flat ended bumps and the encapsulant.

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al., US Patent 6,333,206, in view of Urushima, JP 05-003183, and Applicant's admitted prior art.

Ito teaches a process of producing a semiconductor device comprising:

- 1) providing a printed circuit board (PCB) substrate (1) having a chip mounting area;
- 2) disposing a plurality of spherical connecting electrode portions (2) on the chip mounting area and electrically connected to the substrate;
- 3) depositing an underfill resin layer (13) on the surface of the PCB such that the tops of the connecting electrode portions are exposed; and

4) mounting a semiconductor element (3) such that the electrode portions of the semiconductor element are electrically connected to the exposed ends of the PCB electrode portions (2) (Figures 6 & 7 and 10, 40+).

Ito also fails to teach conductive electrode portions having a flat end that is coplanar with the top of the first encapsulant.

Urushima teaches that the formation of a flat ended conductive bump with is coplanar with an encapsulant layer (Figures).

It would have been obvious to one of ordinary skill in the art at the time of the invention to steps of Urushima in the invention of Ito because flat ended conductive elements formed coplanar with an encapsulant is conventional and well known in the art.

The use of conventional materials to perform their known functions in a conventional process is obvious. In re Raner 134 USPQ 343 (CCPA 1962).

Ito fails to teach the 5<sup>th</sup> and 6<sup>th</sup> steps of the claim, namely the encapsulating of the chip and then the implantation of solder balls on the 2<sup>nd</sup> surface of the substrate.

Applicant's admitted prior art which teaches that it is well known in the art to encapsulate the chip after its attachment to the substrate and also to implant solder balls onto the opposite surface of the substrate (Specification, page 1, 3<sup>rd</sup> paragraph).

It would have been obvious to one of ordinary skill in the art at the time of the invention to steps of Applicant's admitted prior art in the invention of Ito because these are conventional steps used in the packaging art as final steps in a packaging process.

The use of conventional materials to perform their known functions in a conventional process is obvious. In re Raner 134 USPQ 343 (CCPA 1962).

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Regarding claims 2 and 3, Ito teaches the connecting electrode portions as being an eutectic solder bump (5, 29+). Eutectic solder is an alloy of tin and lead.

With respect to claim 4, while Urushima teaches etching back to planarize the encapsulant with the top of the solder bumps, the use of polishing in place of etching back is an equivalent technique for planarizing a surface.

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950)..

As to claim 5, Ito teaches that the connecting electrode portions are connected to the bond pads of the substrate, which are electrically connected to the substrate (5, 9+).

Regarding claim 6, Urushima teaches the 2<sup>nd</sup> encapsulant as encapsulating the entire chip, wherein the 2<sup>nd</sup> surface of the chip has no bond pads (Figure 4).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al., US Patent 6,333,206, in view of Urushima, JP 05-003183, and Applicant's admitted prior art, as applied to claim 1 above, and further in view of Cook et al., US Patent 6,331,446.

Ito, Urushima and Applicant's admitted prior art, all fail to teach the 2<sup>nd</sup> encapsulant exposing the 2<sup>nd</sup> surface of the chip, wherein the 2<sup>nd</sup> surface of the chip has no bond pads.

Cook teaches electrically connecting a chip (18) to a substrate (12) using solder balls (20), depositing a 1<sup>st</sup> underfill material (24) between the chip and the substrate, and then depositing a 2<sup>nd</sup> underfill material (26), wherein the 2<sup>nd</sup> underfill material forms a fillet around the edge of the chip to therefore expose the top surface of the chip.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the fillet 2<sup>nd</sup> underfill material of Cook in the combined inventions of Ito, Urushima and Applicant's admitted prior art because Cook teaches the 2<sup>nd</sup> underfill material creates a circumferentic fillet that surrounds and seals the edges of the chip and the 1<sup>st</sup> underfill to inhibit moisture migration, and cracking of the chip and the 1<sup>st</sup> underfill material (2, 56+).

Claim 8 rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al., US Patent 6,333,206, in view of Urushima, JP 05-003183, and Applicant's admitted prior art as applied to claim 1 above, and further in view of Lai et al., US Patent 6,323,066.

Ito, Urushima and Applicant's admitted prior art, all fail to teach the attachment of a heat sink to the surface of the substrate after the mounting of the chip and its subsequent encapsulation by the 2<sup>nd</sup> encapsulant.

Lai teaches a prior art heat-dissipating structure comprising attaching a chip to a substrate, attaching a heat sink to the substrate and over the top of the chip, and then encapsulating the heat sink and the chip (Figure 6).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the heat sink of Lai in the combined inventions of Ito, Urushima and Applicant's admitted prior art because Lai teaches this type of heat sink attachment

prevents resin flow during the molding process and also prevents the heat sink from causing a thermal compressive stress in the chip during the cooling process (2, 30+).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Zarneke whose telephone number is (703)-305-3926. The examiner can normally be reached on M-Th (7:30-6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David L. Talbott can be reached on (703)-305-9883. The fax phone numbers for the organization where this application or proceeding is assigned are (703)-

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308-7722 for regular communications and (703)-308-7721 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)-308-0956.



David A. Zarneke  
November 5, 2002



DAVID L. TALBOTT  
SUPERVISORY PATENT EXAMINER  
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